



Agreement No. CE 63/2016 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) – Investigation

Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – November 2020

Revision 0

December 2020

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Client:		Project N	0:										
Civil En	gineering and Development Department (CEDD)	0400720											
Summary		Date:											
		11 December 2020											
		Approved by:											
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Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau

Environmental Certification Sheet EP-312/2008/A

Reference Document/Plan

Document/ Plan to be Certified/ Verified:	Monthly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – November 2020
Date of Report:	11 December 2020
Date prepared by ET:	11 December 2020
Date received by IA:	11 December 2020

Reference EP Condition

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/A:

4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all noncompliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

I hereby certify that the above referenced document/ plan complies with the above referenced condit	tion of
EP-312/2008/A	x

Craig Reid, Environmental Team Leader:

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Date: 11/12/2020

IA Verification

I hereby verify that the al	bove referenced document/ plan complies wit	h the above a	referenced condition of
EP-312/2008/A	1		
Dr Wang Wen Xiong, Independent Auditor:	Meno Wars	Date:	11/12/2020

11/12/2020

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Agreement No. CE 63/2016 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2017-2020) - Investigation

MONTHLY EM&A REPORT FOR NOVEMBER 2020

1.1 BACKGROUND

- 1.1.1 The Civil Engineering and Development Department (CEDD) is managing a number of marine disposal facilities in Hong Kong waters, including the Contaminated Mud Pits (CMPs) to the South of The Brothers (SB) and to the East of Sha Chau (ESC) for the disposal of contaminated sediment, and opensea disposal grounds located to the South of Cheung Chau (SCC), East of Tung Lung Chau (ETLC) and East of Ninepins (ENP) for the disposal of uncontaminated sediment. Two Environmental Permits (EPs), EP-312/2008/A and EP-427/2011/A, were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 and 23 December 2011 for the Dredging, Management and Capping of Contaminated Sediment Disposal Facilities at ESC CMP V and SB CMPs, respectively.
- 1.1.2 Under the requirements of the two EPs for ESC CMP V and SB CMPs, EM&A programmes which encompass water and sediment chemistry, fisheries assessment, tissue and whole body analysis, sediment toxicity and benthic recolonisation studies as set out in the EM&A Manuals are required to be implemented. EM&A programmes have been continuously carried out during the operation of the CMPs at ESC and SB. A review of the collection and analysis of such environmental data from the monitoring programme demonstrated that there had not been any adverse environmental impacts resulting from disposal activities ⁽¹⁾ ⁽²⁾. The current programme will assess the impacts resulting from dredging, disposal and capping operations of CMP V as well as capping operations of SB CMPs.
- 1.1.3 The present EM&A programme under *Agreement No. CE 63/2016 (EP)* covers the dredging, disposal and capping operations of the ESC CMP V as well as the capping operations of the SB CMPs (see *Annex A* for the EM&A programme). The scheduled EM&A programme for SB CMPs was completed in December 2018. Detailed works schedule for ESC CMP V is shown in *Figure 1.1*. In November 2020, the following works were undertaken:
 - Disposal of contaminated mud at ESC CMP Vb; and
 - Capping operations at ESC CMP Vd.
 - ERM (2013) Final Report. Submitted under Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pit at East Sha Chau. For CEDD.
 - (2) ERM (2017) Final Report. Submitted under Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012 2017). For CEDD.

Figure 1.1 Works Schedule for ESC CMP V

Dit	Oneration	2017							2018									2019									2020									2021												
Pit	Operation	Α	М	J	J	Α	S	C) N	D	J	F	М	A	Μ	J	J	Α	s	0	Ν	D	J	F	M	A	М	J	J	AS	S (D	N	J	F	M	Α	М	J	J	Α	s	ο	N	D.	J	F	v
	Dredging																																															
ESC CMP V	Disposal																																															
	Capping																																															

1.2 **REPORTING PERIOD**

- 1.2.1 This *Monthly EM&A Report for November* 2020 covers the EM&A activities for the reporting month of November 2020.
- **1.3** DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES
- 1.3.1 The following monitoring activities were undertaken for ESC CMP V in November 2020:
 - Water Column Profiling of ESC CMP Vb;
 - Routine Water Quality Monitoring of ESC CMPs; and
 - Pit Specific Sediment Chemistry of ESC CMP Vb.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for November 2020.
- 1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMP V
- 1.5.1Brief discussion of the monitoring results of the following activities for ESC
CMP V is presented in this *Monthly EM&A Report for November* 2020:
 - Water Column Profiling of ESC CMP Vb;
 - Routine Water Quality Monitoring of ESC CMPs; and
 - *Pit Specific Sediment Chemistry of ESC CMP Vb.*

1.5.2 Water Column Profiling of ESC CMP Vb - November 2020

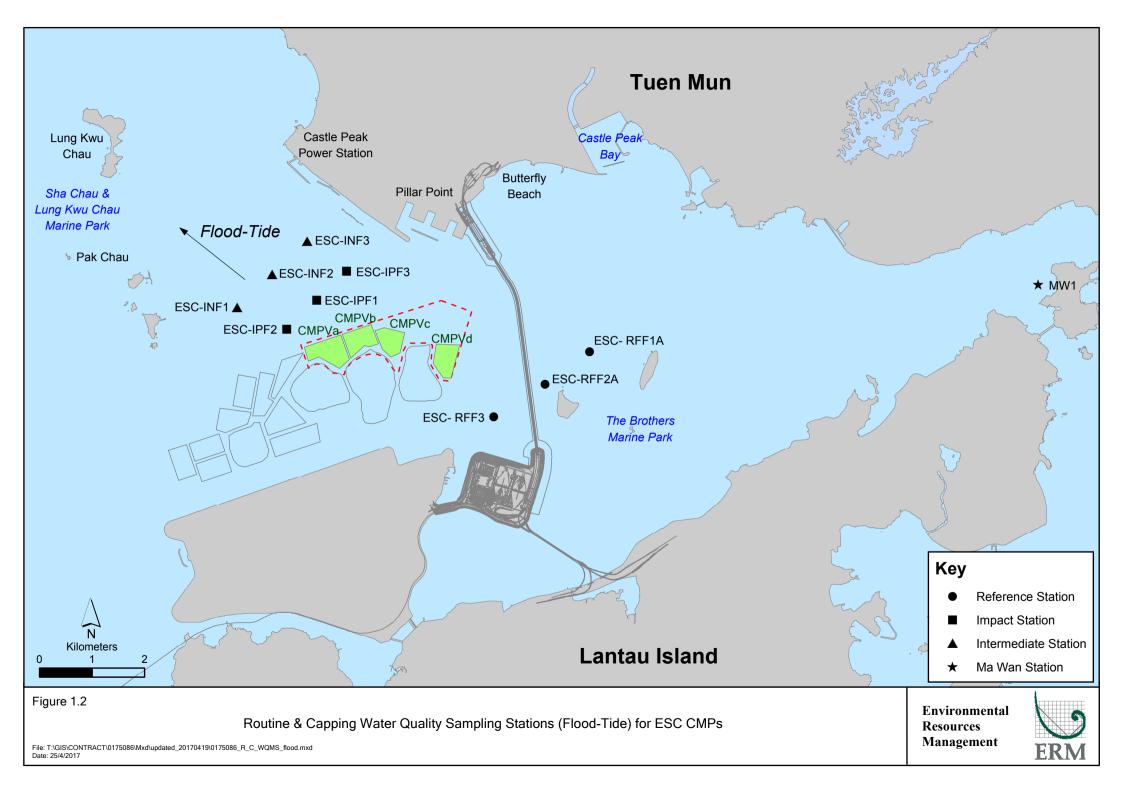
1.5.3 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 November 2020. The monitoring results have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 2009 - 2018 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located ⁽¹⁾. For Salinity, the averaged value obtained from the Reference (Upstream) station was used for the basis as the WQO. Levels of Dissolved Oxygen (DO) and Turbidity were also assessed for compliance with the Action and Limit Levels (see *Table B1* of *Annex B* for details).

In-situ Measurements

1.5.4 Analyses of results for November 2020 indicated that levels of Salinity, pH and DO complied with the WQOs at both Downstream and Upstream stations (*Table B2* of *Annex B*). Levels of DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

- 1.5.5 Analyses of results November 2020 indicated that the SS levels at both Downstream and Upstream stations complied with the WQO and the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).
- 1.5.6 Overall, the monitoring results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any deterioration in water quality during this reporting period.
- 1.5.7 Routine Water Quality Monitoring of ESC CMPs November 2020
- 1.5.8 Routine Water Quality Monitoring of ESC CMPs was undertaken on 5 November
 2020. The monitoring results have been assessed for compliance with the
 WQOs (see Section 1.5.3 for details). The monitoring results are shown in
 Tables B3 and B4 of Annex B and Figures 1 10 of Annex C. A total of ten (10)
 monitoring stations were sampled in November 2020 as shown in Figure 1.2.

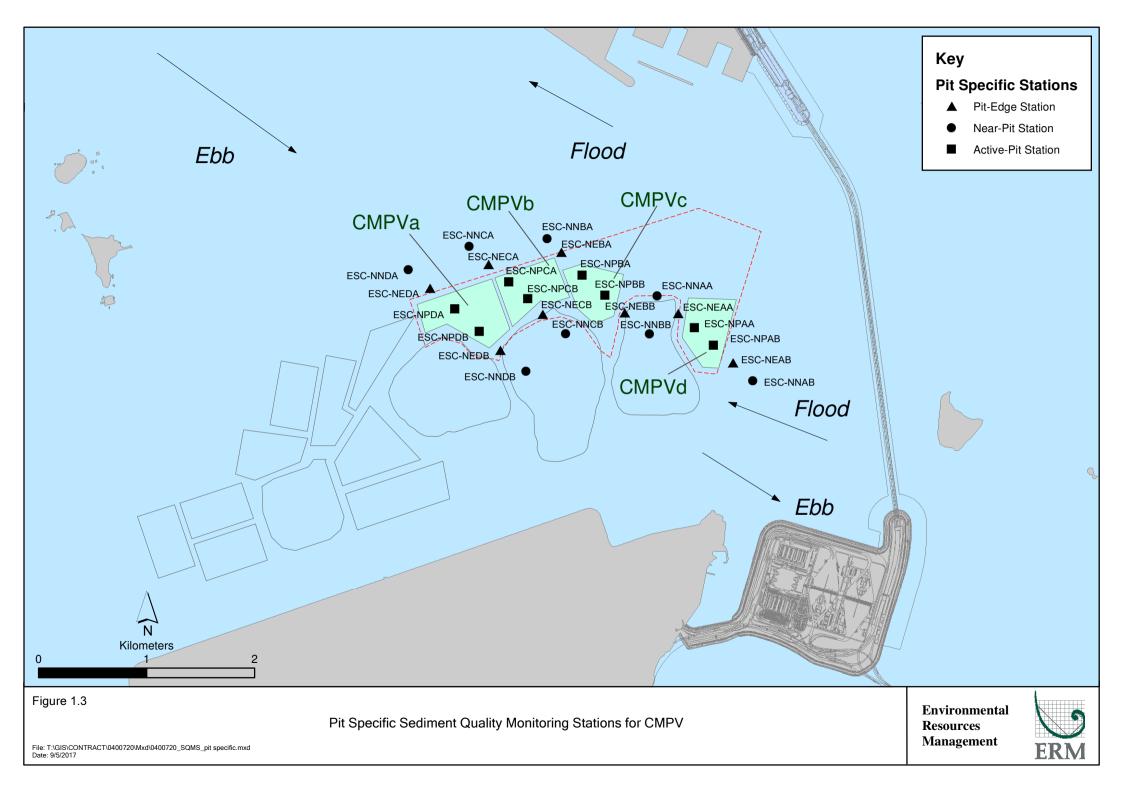


In-situ Measurements

1.5.9	Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in <i>Figures 1 - 6</i> of <i>Annex C</i> . Analyses of results indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations in November 2020.
1.5.10	The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (<i>Table B3</i> of <i>Annex B</i> ; <i>Figures 3</i> and 6 of <i>Annex C</i>).
1.5.11	Overall, <i>in-situ</i> measurement results of the <i>Routine Water Quality Monitoring</i> indicated that the disposal operation at ESC CMP Vb did not appear to cause any unacceptable impacts in water quality in November 2020.
	Laboratory Measurements
1.5.12	Laboratory analysis of November 2020 results indicated that concentrations of Arsenic, Chromium, Copper, Lead, Nickel and Zinc were detected in November 2020 samples at most stations and the concentrations of Zinc, Chromium, Lead, Nickel and Copper were higher at Ma Wan and Reference stations (<i>Table B4</i> of <i>Annex B; Figure 7</i> of <i>Annex C</i>).
1.5.13	For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at Ma Wan and Reference stations were higher than the WQO (0.5 mg/L) (<i>Table B4</i> of <i>Annex B; Figure 8</i> of <i>Annex C</i>). It should be noted that due to the effect of the Pearl River, the North Western WCZ has historically experienced higher levels of TIN ⁽¹⁾ . Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMPs. The concentrations of Ammonia Nitrogen (NH ₃ -N) were similar across all stations in November 2020 (<i>Table B4</i> of <i>Annex B; Figure 8</i> of <i>Annex C</i>). The concentrations of Biochemical Oxygen Demand (BOD ₅) were higher at Reference stations (<i>Table B4</i> of <i>Annex B; Figure 9</i> of <i>Annex C</i>).
1.5.14	Analyses of results for November 2020 indicated that the SS levels at all stations complied with the WQO and the Action and Limit Levels (<i>Tables B1 and B4</i> of <i>Annex B; Figure 10</i> of <i>Annex C</i>).
1.5.15	Overall, results of the <i>Routine Water Quality Monitoring</i> indicated that the disposal operation at ESC CMPs did not appear to cause any unacceptable deterioration in water quality in November 2020. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.

(1) http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm

- 1.5.16 *Pit Specific Sediment Chemistry of ESC CMP Vb November* 2020
- 1.5.17 Monitoring locations for *Pit Specific Sediment Chemistry for ESC CMP Vb* are shown in *Figure 1.3.* A total of six (6) monitoring stations were sampled on 4 November 2020.
- 1.5.18 The concentrations of most inorganic contaminants were lower than the Lower Chemical Exceedance Levels (LCELs) at most stations, except for Arsenic (*Figures 11 and 12* of *Annex C*). The concentrations of Arsenic were higher than the LCEL at Pit-Edge station ESC-NECA and Active-Pit stations ESC-NPCB.
- 1.5.19 Whilst the average concentration of Arsenic in the Earth's crust is generally ~2mg/kg, significantly higher Arsenic concentrations (median = 14 mg/kg) have been recorded in Hong Kong's onshore sediments ⁽¹⁾. It is presumed that the natural concentrations of Arsenic are similar in onshore and offshore sediments ⁽²⁾, and relatively high Arsenic levels may thus occur throughout Hong Kong. Therefore, the LECL exceedances of Arsenic are unlikely to be caused by the disposal operations at ESC CMP Vb but rather as a result of naturally occurring deposits.
- 1.5.20 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were higher at Active-Pit stations ESC-NPCA and ESC-NPCB in November 2020 (*Figure 13 of Annex C*). The concentrations of Low Molecular Weight and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) were lower than the LECLs at Near-Pit and Pit-Edge stations. However, the concentrations of Low Molecular Weight PAHs were higher than the Upper Chemical Exceedance Level (UCEL) and the concentrations of High Molecular Weight PAHs were higher than the LCEL at Active-Pit stations ESC-NPCA and ESC-NPCB (*Figure 14 of Annex C*). The concentrations of Tributyltin (TBT) were higher at Active-Pit stations ESC-NPCA and ESC-NPCB (*Figure 15 of Annex C*). The concentrations of Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'- dichlorodiphenyldichloroethylene (DDE) were below the limit of reporting at all stations in November 2020.
- 1.5.21 Considering that the higher levels of TOC, TBT, Low Molecular Weight and High Molecular Weight PAHs occurred within Active-Pit stations ESC-NPCA and ESC-NPCB only, there is no evidence indicating any unacceptable environmental impacts to sediment quality outside the pit area as a result of the contaminated mud disposal operations at ESC CMP Vb in November 2020.
- 1.5.22 Statistical analysis will be undertaken and presented in the corresponding quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.
 - (1) Sewell RJ (1999) Geochemical Atlas of Hong Kong. Geotechnical Engineering Office, Government of the Hong Kong Special Administrative Region
 - (2) Whiteside PGD (2000) Natural geochemistry and contamination of marine sediments in Hong Kong. In: The Urban Geology of Hong Kong (ed Page A & Reels SJ). Geological Society of Hong Kong Bulletin No. 6, p109-121



1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of December 2020 for ESC CMP V (see *Annex A* for the sampling schedule ⁽¹⁾⁽²⁾):
 - Water Column Profiling of ESC CMP Vb;
 - Routine Water Quality Monitoring of ESC CMPs;
 - Pit Specific Sediment Chemistry of ESC CMP Vb; and
 - Cumulative Impact Sediment Chemistry of ESC CMPs.

1.7 STUDY PROGRAMME

1.7.1 A summary of the Study Programme is presented in *Annex D*.

(1) The scheduled EM&A Programme for SB CMPs was completed in December 2018.

⁽²⁾ A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes will be effective for the EM&A activities since December 2020. The latest sampling schedule is provided in *Annex A*.

Annex A

Sampling Schedule

Annex A1 - East of Sha Chau Environmental Monitoring and Audit Sampling Schedule for CMP (April 2017 - March 2021)

Pit Specific Sediment Chemistry *	Codo	Eroquonau)17 N				20							2 019			ND	TE		M	2020			N		2021 E M
Pit Specific Sediment Chemistry * Active-Pit	Code ESC-NPAA	Frequency Monthly		12	12 12		12 12	12		12 12	12 1	12 12	F M 2 12 12	12 12	12 12	12 12			12 12	12 12		12 12	12 12		12	6 6	F M 6 6
Pit-Edge	ESC-NPAB ESC-NEAA	Monthly Monthly											2 12 12 2 12 12 2 12 12														6 6 6 6
Near-Pit	ESC-NEAB	Monthly	12 12	12	12 12	12 12	12 12	12	12 12	12 12	12 1	12 12	2 12 12	12 12	12 12	12 12	2 12	12 12	12 12	12 12	2 12	12 12	12 12	2 12	12	6 6	6 6
	ESC-NNAA ESC-NNAB	Monthly Monthly											2 12 12 2 12 12														6 6 6 6
Cumulative Impact Sediment Chem Near-field Stations	nistry *		S O	N	D J	F M	A M	J	J A	S O	N 1	D J	F M	A M	J J	A S	0	N D	J F	M A	M	J J	A S	0	NI	D J	F M
Mid-field Stations	ESC-RNA ESC-RNB1	4 times per year 4 times per year			12 12	12 12		12 12	12 12			12 12	12 12		12 12	12 12		12 12	12 12			12 12	12 12				6 6
Mid-field Stations	ESC-RMA ESC-RMB	4 times per year 4 times per year			12 12	12 12		12 12	12 12			12	12 12 12		12 12 12	12 12		12 12	12 12			12 12	12 12				6 6
Capped Pit Stations	ESC-RCA1 ESC-RCB1	4 times per year			12 12	12 12		12 12	12 12			12	12 12		12 12	12 12		12 12	12 12			12 12	12 12				6 6
Far-Field Stations	ESC-RCDI	4 times per year 4 times per year			12	12		12	12		1	12	12		12	12		12	12			12	12				6
Ma Wan Station	ESC-RFB MW1	4 times per year 4 times per year			12 12	12 12		12 12	12 12			12	12 12 12		12 12	12 12		12 12	12 12			12 12	12 12				6
Sediment Toxicity Tests	141441	4 times per year	S O			F M	A M	_	J A				F M	A M		A S	0	N D	J F		M			0			F M
Near-Pit Stations	ESC-TDA	2 times per year				5			5				5			5			5				5		\square		5
Reference Stations	ESC-TDB1 ESC-TRA	2 times per year 2 times per year				5			5				5			5			5				5		++		5
Ma Wan Station	ESC-TRB MW1	2 times per year				5			5				5			5			5				5				5
Tissue/ Whole Body Sampling	IVI V I	2 times per year	S O	N	D J	5 F M	A M	J	5 J A	S O	N	D J	F M	A M	JJ	A S	0	N D			M	JJ	-	0	NI		5 F M
Near-Pit Stations	ESC-INA ESC-INB	2 times per year				*			*				*			*			*				*				*
Reference North	ESC-INB TNA	2 times per year 2 times per year				*			*				*			*			*				*		++	+	*
Reference South	TNB	2 times per year				*			*				*			*			*				*				*
	TSA TSB	2 times per year 2 times per year				*			*				*			*			*				*				*
Demersal Trawling Near Pit Stations		A .:	S O	N	D J	F M	A M	J	J A	S O	N 1	D J	F M	A M	J J	A S	0	N D	J F	M A	M	J J	A S	0	NI		F M
Reference North	ESC-INA ESC-INB	4 times per year 4 times per year			5	5 5			5 5 5 5			5	5		55	5 5			5 5 5 5			5 5	5 5				5
	TNA TNB	4 times per year 4 times per year			5	55			5 5 5 5			5			5	U			5 5 5 5			5	55				5
Reference South	TSA TSB	4 times per year 4 times per year			5	555			5 5 5 5			5			5				55 55	<u> </u>		55			Ħ		5 5
Capping *	100	4 tines per year	S O	N			A M	J			N		F M	A M	U	U	0	N D			M	I I	I I	0	N		
<i>Ebb Tide</i> Impact Station Downcurrent					y																						
	ESC-IPE1A ESC-IPE2A ESC-IPE3	4 times per year * 4 times per year * 4 times per year *																	3 3 3			3 3 3	3 3 3		++	+	
	ESC-IPE4 ESC-IPE5	4 times per year * 4 times per year *																	3			3 3	3 3				
Intermediate Station Downcurrent	ESC-INE1A ESC-INE2A	4 times per year * 4 times per year *																	3			3 3	3			+	
	ESC-INE3A ESC-INE4A	4 times per year * 4 times per year *																	3			3 3	3 3				
Reference Station Upcurrent	ESC-INE5A ESC-RFE1	4 times per year * 4 times per year *																	3			3	3				
	ESC-RFE2 ESC-RFE3	4 times per year * 4 times per year *																	3 3			3 3 3	3 3 3		++	+	
Ma Wan Station	ESC-RFE4 ESC-RFE5	4 times per year * 4 times per year *																	3			3 3	3 3				
Flood Tide	MW1	4 times per year *																	3			3	3				
Impact Station Downcurrent	ESC-IPF1	4 times per year *																	3			3	3		\square	\perp	
Intermediate Station Downcurrent	ESC-IPF2 ESC-IPF3	4 times per year * 4 times per year *																	3			3 3	3 3		++	+	
	ESC-INF1 ESC-INF2	4 times per year * 4 times per year *																	3			3 3	3 3				
Reference Station Upcurrent	ESC-INF3 ESC-RFF1A	4 times per year * 4 times per year *																	3			3 3	3		++	+	
	ESC-RFF2A ESC-RFF3	4 times per year * 4 times per year *																	3			3 3	3 3				
Ma Wan Station	MW1	4 times per year *																	3			3	3				
Routine Water Quality Monitoring <i>Ebb Tide</i>	*		S O	Ν	D J	F M	A M	J	J A	S O	N 1	D J	F M	A M	J J	A S	0	N D	J F	M A	Μ	J J	A S	0	N	D J	F M
Impact Station Downcurrent	ESC-IPE1A ESC-IPE2A	Monthly * Monthly *	8		8		88 88		88 88	8		8	_	88 88 88		~	8	8	88 88	8	8	8		8	_		$\begin{array}{c c} & \\ \hline 4 & 4 \\ \hline 4 & 4 \end{array}$
	ESC-IPE3 ESC-IPE4	Monthly * Monthly *	8 8	Ū	8 8 8	8	0 0 8 8 8 8	_	0 0 8 8 8 8		8	8	8	8 8 8 8	8	8	8 8	8 8 8	0 0 8 8 8 8	-	8	8 8 8	8	8 8 8	8	4 4	4 4 4 4 4 4
Intermediate Station Downcurrent	ESC-IPE5	Monthly *	8		8	8	8 8 8 8		8 8	8	8	8		8 8	8	8	8	8	8 8		8	8	8	8	8 4		4 4
	ESC-INE1A ESC-INE2A ESC-INE3A	Monthly * Monthly * Monthly *	8 8 8	Ũ	8 8 8	8	8 8 8 8 8 8 8 8		8 8 8 8 8 8 8 8	8 8 8	8	8 8 8	8	8 8 8 8 8 8 8 8	8	8	8 8 8	8 8 8	8 8 8 8 8 8	8 8 8 8	8	8 8 8 8	8	8 8 8	8		$ \begin{array}{c ccc} 4 & 4 \\ \hline 4 & 4 \\ \hline 4 & 4 \\ \end{array} $
Potoronas Challens II	ESC-INE4A ESC-INE5A	Monthly * Monthly *	8	8	8	8	8 8 8 8		8 8 8 8	8	8	8	8	8 8 8 8	8	8	8	8 8	8 8 8 8	8		8	8	8	8	4 4	4 4 4 4
Reference Station Upcurrent	ESC-RFE1 ESC-RFE2	Monthly * Monthly *	8 8		8		8 8 8 8		8 8 8 8	8		8		8 8 8 8		-	8 8	8 8	8 8 8 8	8	8	8 8		8 8			4 4 4 4
	ESC-RFE3 ESC-RFE4	Monthly * Monthly *	8 8	8 8	8 8	8 8	8 8 8 8		8 8 8 8	8	8 8	8 8	8 8	8 8 8 8	8 8	8 8	8 8	8 8 8	8 8 8 8	8	8 8	8 8	8 8	8 8	8 4 8 4	4 4 4 4	4 4 4 4
Ma Wan Station	ESC-RFE5 MW1	Monthly * Monthly *	8		8		8 8 8 8 8 8		8 8 	8		8		8 8 8 8 8 8		0	8 8 8	8	8 8 8 8		8	8 8 8		8			4 4 4 4
<i>Flood Tide</i> Impact Station Downcurrent		,				 				· · · ·	· · · ·				 			0									
	ESC-IPF1 ESC-IPF2 ESC-IPF3	Monthly * Monthly * Monthly *	8 8 8	8 8 8			8 8 8 8 8 8		8 8 8 8 8 8	8 8 8	8	8 8 8	8	8 8 8 8 8 8 8 8		Ŭ	8 8 8	8 8 8	8 8 8 8 8 8	8 8 8	8 8 8	8 8 8		8 8 8	8	4 4	4 4 4 4 4 4
Intermediate Station Downcurrent	ESC-INF1	Monthly *	8	8			8 8		8 8	8	8	8	8	8 8	8	8	8	8	8 8	8	8	8	8	8	8 4	4 4	4 4
Reference Station Upcurrent	ESC-INF2 ESC-INF3	Monthly * Monthly *	8	8 8			8 8 8 8		8 8 8 8	8		8		8 8 8 8		-	8 8	8 8	8 8 8 8	8	8	8 8	8 8	8 8	Ŭ	4 4 4 4	4 4 4 4
omuon opeunem	ESC-RFF1A ESC-RFF2A	Monthly * Monthly *	8 8	8			8 8 8 8 8 8		8 8 8 8	8	8	8	8	8 8 8 8 8 8	8	8	8 8	8 8	8 8 8 8	8	8	8 8 8	8	8 8	8	4 4	4 4 4 4
Ma Wan Station	ESC-RFF3 MW1	Monthly * Monthly *	8	8			8 8 8 8 8		8 8 	8		8		8 8 8 8 8			8	8	8 8 	8	8	8	8	8		4 4 4	4 4
Water Column Profiling *			S O	N	D J	F M	A M	_	J A	S O	N 1		F M	A M	JJ	A S	0	N D	J F	M A	Μ	JJ	A S	0	NI	D J	F M
Plume Stations	WCP1 WCP2	Monthly Monthly	$\begin{array}{c c} 4 & 4 \\ \hline 4 & 4 \end{array}$	+	4 4 4 4			4 4	$\begin{array}{c c} 4 & 4 \\ 4 & 4 \end{array}$			$\begin{array}{c c}4 & 4\\4 & 4\end{array}$		4 4 4 4			4	4 4 4 4			4	$\begin{array}{c c} 4 & 4 \\ 4 & 4 \end{array}$	<u> </u>	4 4	4 2 4 2		2 2 2 2
Benthic Recolonisation Studies Capped Stations at CMPV			S O	N	D J	F M	A M	J	J A	S O	N 1	D J	F M	A M	J J	A S	0	N D	J F	M A	M	J J	A S	0	N I	D J	F M
	ESCV-CPA ESCV-CPB	2 times per year 2 times per year 2 times per year																							\square	\blacksquare	
Reference Stations	ESCV-CPC ESCV-CPD	2 times per year 2 times per year									+															+	
	RBA RBB	2 times per year 2 times per year																									
Immediate	RBC1	2 times per year							T									NT									
Impact Monitoring for Dredging Upstream Stations	US1	3 times per week	S 0 2	N	D J	F M	A M		JA	S O	N 1		F M	A M	JJ	A S	0	N D 2 2	JF	M A	M	JJ	A S	0	N I		F M
Downstream Stations	US2	3 times per week	2									+						2 2			\downarrow			+	Ħ		
	DS1 DS2 DS3	3 times per week 3 times per week 3 times per week	2 2 2									+						2 2 2 2 2 2			+			+	╞┼╴	$+ \overline{+}$	
	DS3 DS4 DS5	3 times per week 3 times per week 3 times per week	2 2 2															2 2 2 2 2 2									
Ma Wan Station Notes:	MW1	3 times per week	2															2 2									

The number shown in each cell represents the numbers of replicates per monitoring station Impact Monitoring for Dredging will be scheduled when dredging operations commence. Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

* A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes will be effective for the EM&A activities since December 2020. Water Quality Monitoring during Capping Operation and Routine Water Quality Monitoring are combined such that Routine Water Quality Monitoring will be conducted monthly starting in December 2020.

Annex B

Water Quality Monitoring Results

Parameter	Action Level	Limit Level
Dissolved Oxygen (DO) (1)	Surface and Mid-depth ⁽²⁾	Surface and Mid-depth ⁽²⁾
	5%-ile of baseline data for surface and	1%-ile of baseline data for surface and
	middle layer = 3.76 mg L ⁻¹	middle layer = 3.11 mg L ⁻¹ ⁽³⁾
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
	Bottom 5%-ile of baseline data for bottom layers = 2.96 mg L -1	Bottom The average of the impact station readings are <2 mg/L -1
	and	and
	Significantly less than the reference stations mean DO (at the same tide of the same day)	Significantly less than the reference stations mean DO (at the same tide of the same day)
Depth-averaged Suspended Solids (SS) ^{(4) (5)}	95%-ile of baseline data for depth average = 37.88 mg L ⁻¹	99%-ile of baseline data for depth average = 61.92 mg L -1
	and	and
	120% of control station's SS at the same tide of the same day	130% of control station's SS at the same tide of the same day
Depth-averaged Turbidity (Tby) ^{(4) (5)}	95%-ile of baseline data = 28.14 NTU	99%-ile of baseline data = 38.32 NTU
(-~))	and	and
	120% of control station's Tby at the same tide of the same day	130% of control station's Tby at the same tide of the same day

Table B1Action and Limit Levels of Water Quality for Dredging, Disposal and
Capping Activities at ESC CMP V

Notes:

(1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

(2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.

(3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L⁻¹, it is proposed to set the Limit Level at 3.11 mg L⁻¹ which is the first percentile of the baseline data.

(4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.

(5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Stations	Temp	Salinity	Turbidity	Dissolved	l Oxygen	pН	Suspended Solids
	(°C)	(ppt)	(NTU)	(%)	(mg L-1)		(mg L-1)
WCP 1 (Downstream)	24.99	31.61	3.15	91.89	6.35	8.03	6.35
WCP 2 (Upstream)	25.08	31.17	2.11	95.91	6.63	8.02	4.20
WQO (Dry Season)	N/A	28.06-34.29#	N/A	N/A	>4	6.5-8.5	13.6

Note:

*Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station. Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value exceeding the WQO.

Table B3In-situ Monitoring Results for Routine Water Quality Monitoring of ESC
CMPs in November 2020

Sampling Period	Stations	Temp	Salinity	Turbidity	Dissolve	pН	
	Stations	(°C)	(ppt)	(NTU)	(%)	(mg L-1)	(mg L-1)
November	RFF (Reference)	24.59	31.98	5.03	96.78	6.71	8.03
2020	IPF (Impact)	24.60	31.95	3.85	97.69	6.78	8.01
	INF (Intermediate)	24.66	31.87	2.29	98.80	6.85	8.00
	Ma Wan	24.77	32.51	2.19	88.20	6.08	7.96
	WQO	N/A	28.78-35.17#	N/A	N/A	>4	6.5-8.5

Notes:

*Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value higher than the WQO.

Table B4Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in
November 2020

Sampling Period	Stations	As (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Pb (µg/L)	Hg (µg/L)	Ni (µg/L)	Ag (µg/L)	Zn (µg/L)	NH3 (mg/ L)	TIN (mg/L)	BOD5 (mg/L)	SS (mg/L)
November	RFF	2.03	<lor< td=""><td>1.47</td><td>28.28</td><td>2.03</td><td><lor< td=""><td>1.30</td><td><lor< td=""><td>57.90</td><td>0.15</td><td>0.55</td><td>1.40</td><td>11.62</td></lor<></td></lor<></td></lor<>	1.47	28.28	2.03	<lor< td=""><td>1.30</td><td><lor< td=""><td>57.90</td><td>0.15</td><td>0.55</td><td>1.40</td><td>11.62</td></lor<></td></lor<>	1.30	<lor< td=""><td>57.90</td><td>0.15</td><td>0.55</td><td>1.40</td><td>11.62</td></lor<>	57.90	0.15	0.55	1.40	11.62
2020	IPF	2.04	<lor< td=""><td>0.92</td><td>7.72</td><td>0.66</td><td><lor< td=""><td>0.92</td><td><lor< td=""><td>38.60</td><td>0.14</td><td>0.44</td><td>0.50</td><td>11.66</td></lor<></td></lor<></td></lor<>	0.92	7.72	0.66	<lor< td=""><td>0.92</td><td><lor< td=""><td>38.60</td><td>0.14</td><td>0.44</td><td>0.50</td><td>11.66</td></lor<></td></lor<>	0.92	<lor< td=""><td>38.60</td><td>0.14</td><td>0.44</td><td>0.50</td><td>11.66</td></lor<>	38.60	0.14	0.44	0.50	11.66
	INF	2.00	<lor< td=""><td>0.68</td><td>6.22</td><td>0.52</td><td><lor< td=""><td>0.81</td><td><lor< td=""><td>37.32</td><td>0.15</td><td>0.45</td><td>0.68</td><td>11.77</td></lor<></td></lor<></td></lor<>	0.68	6.22	0.52	<lor< td=""><td>0.81</td><td><lor< td=""><td>37.32</td><td>0.15</td><td>0.45</td><td>0.68</td><td>11.77</td></lor<></td></lor<>	0.81	<lor< td=""><td>37.32</td><td>0.15</td><td>0.45</td><td>0.68</td><td>11.77</td></lor<>	37.32	0.15	0.45	0.68	11.77
	Ma Wan	1.98	<lor< td=""><td>1.28</td><td>22.43</td><td>2.58</td><td><lor< td=""><td>1.38</td><td><lor< td=""><td>88.99</td><td>0.21</td><td>0.53</td><td>1.09</td><td>7.21</td></lor<></td></lor<></td></lor<>	1.28	22.43	2.58	<lor< td=""><td>1.38</td><td><lor< td=""><td>88.99</td><td>0.21</td><td>0.53</td><td>1.09</td><td>7.21</td></lor<></td></lor<>	1.38	<lor< td=""><td>88.99</td><td>0.21</td><td>0.53</td><td>1.09</td><td>7.21</td></lor<>	88.99	0.21	0.53	1.09	7.21
												WQO of	f TIN: 0.	5 mg/L
										Dry S	eason	WQO of	SS:13.	6 mg/L

Notes:

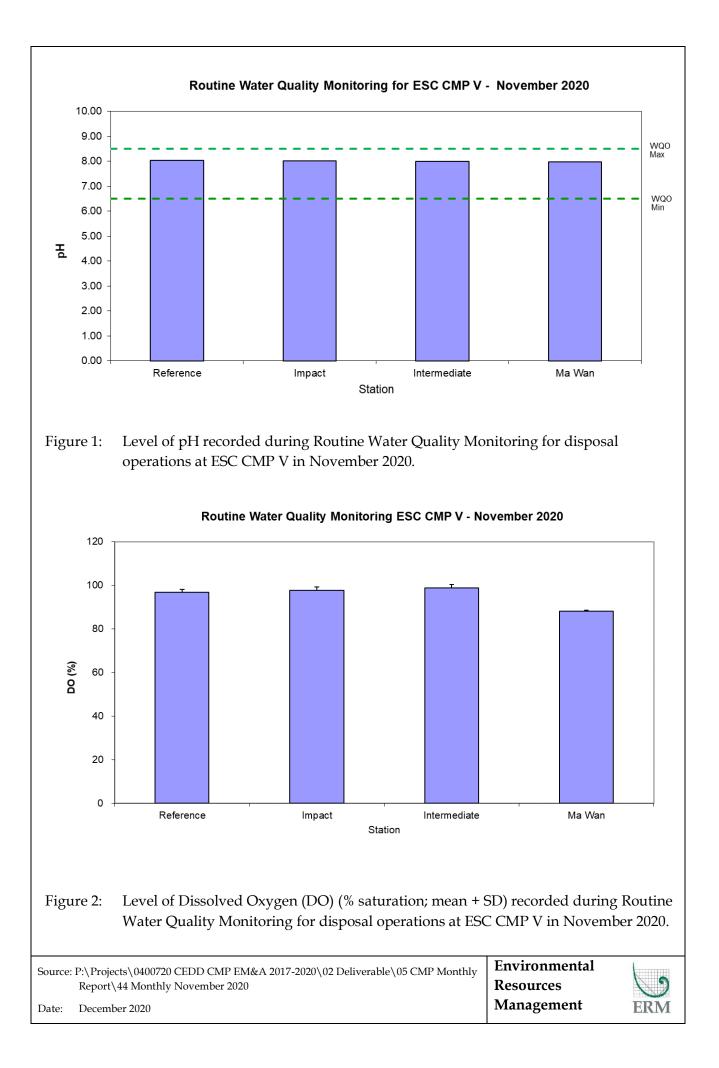
<LOR indicates the concentrations of metals and metalloids are below the limit of reporting

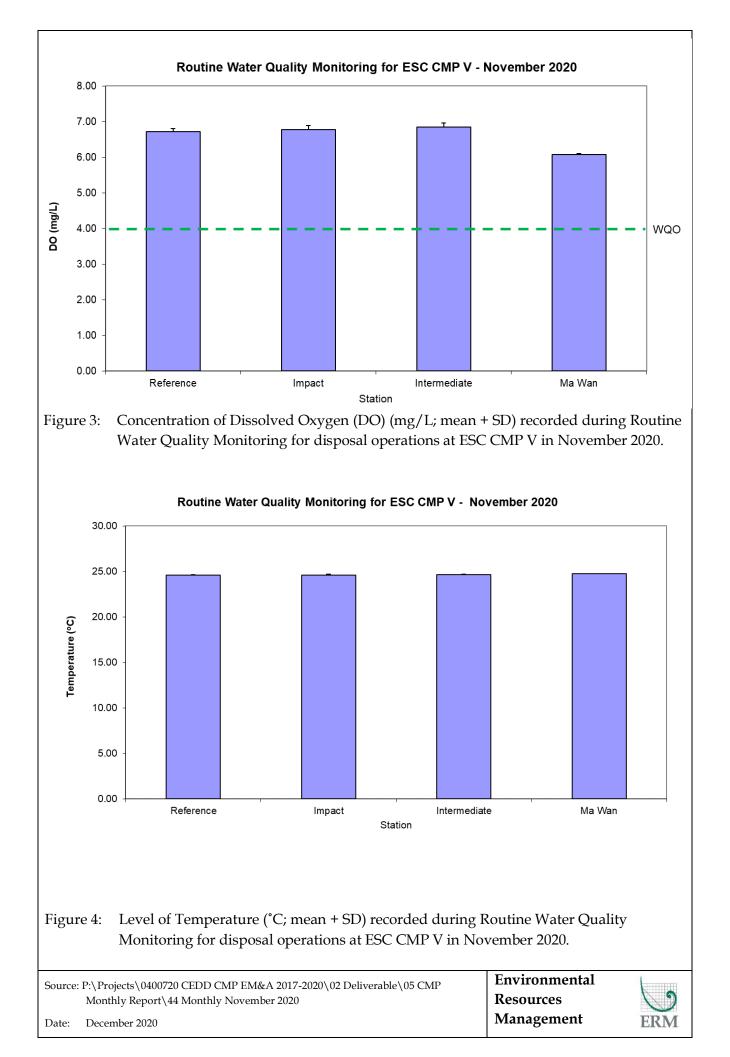
Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

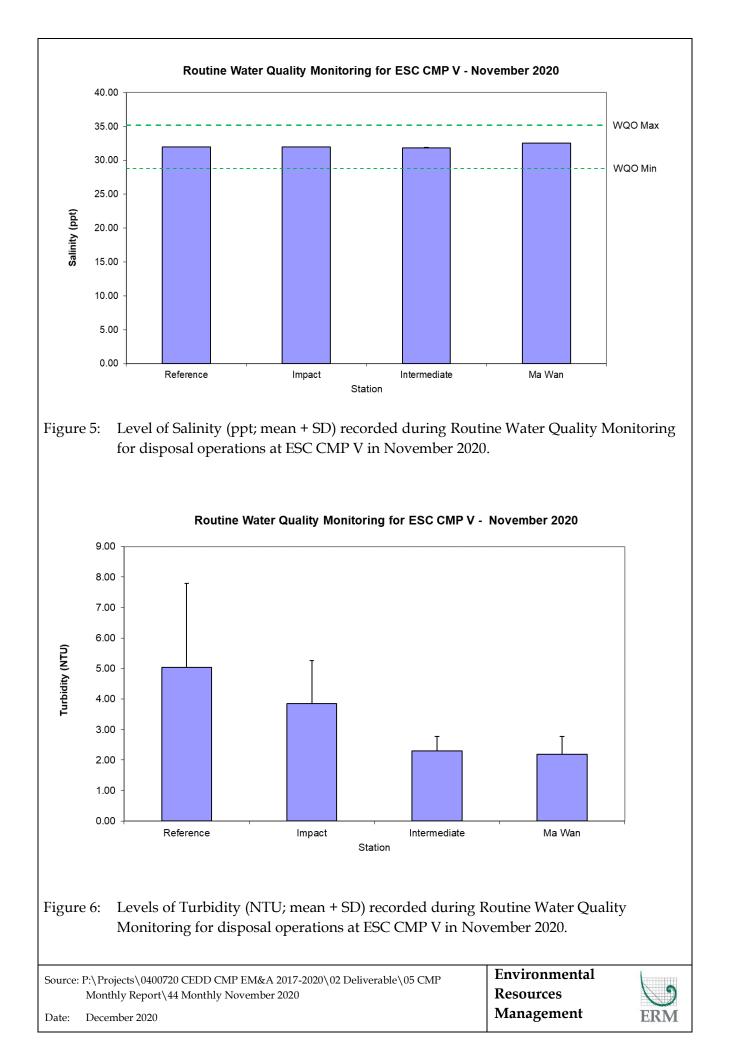
Cell shaded grey indicate value higher than the WQO.

Annex C

Graphical Presentations







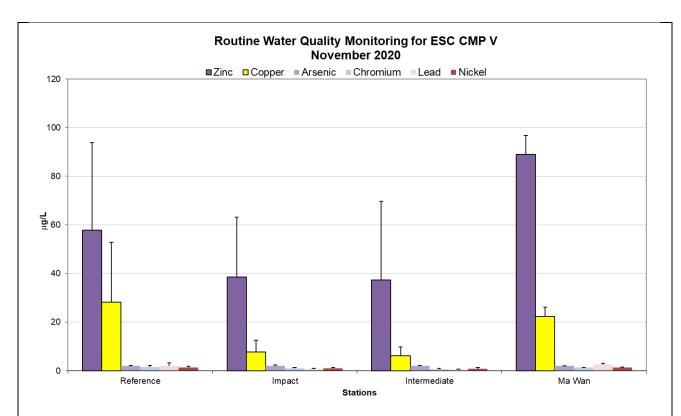
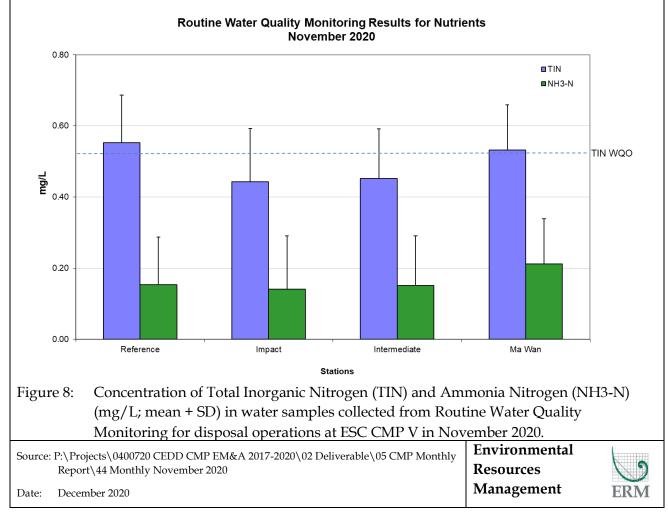
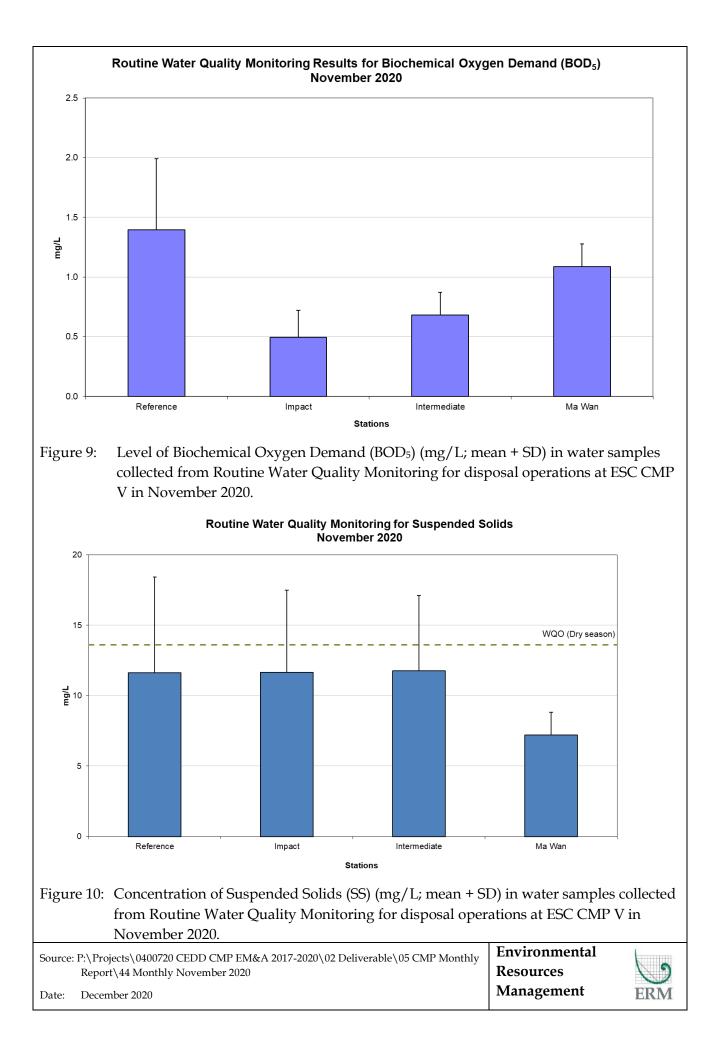
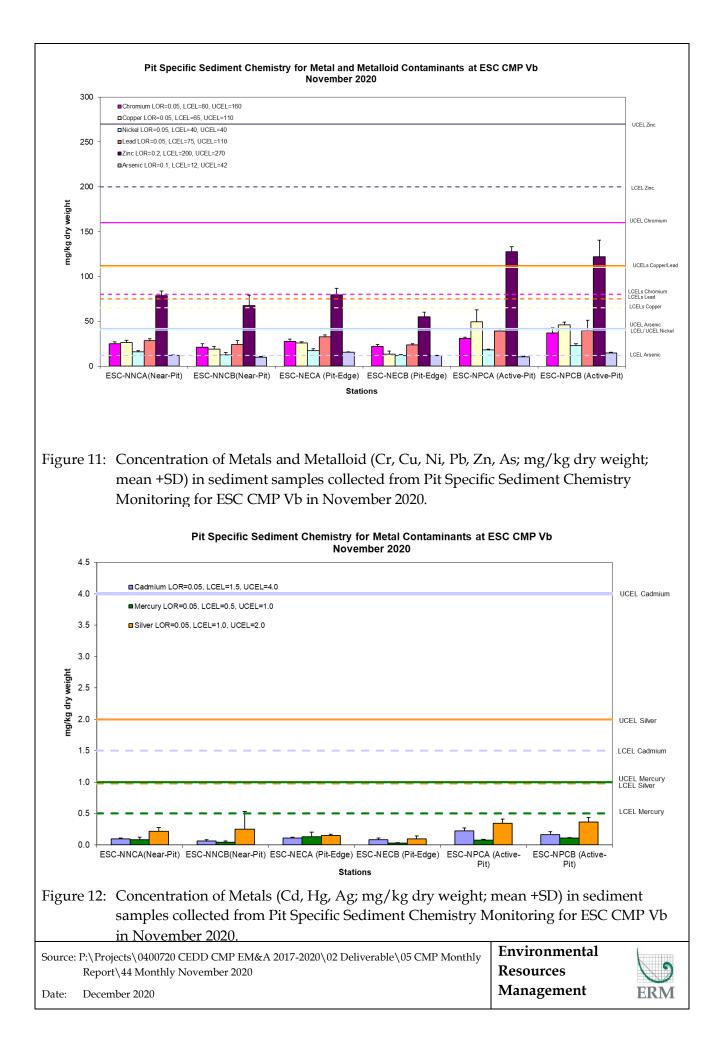
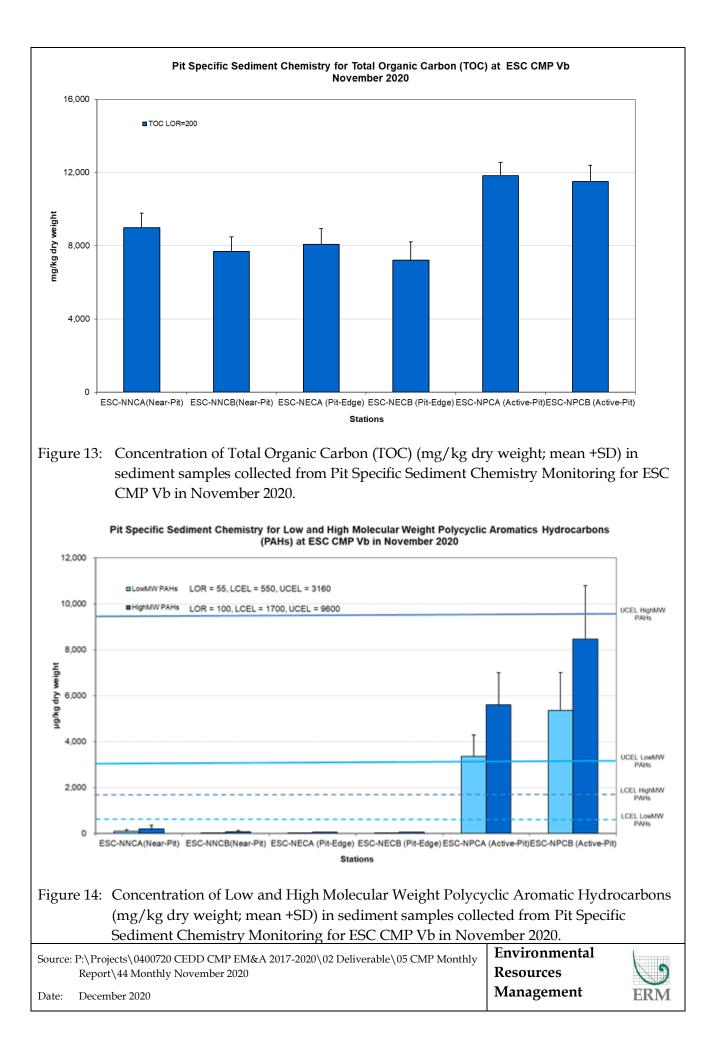


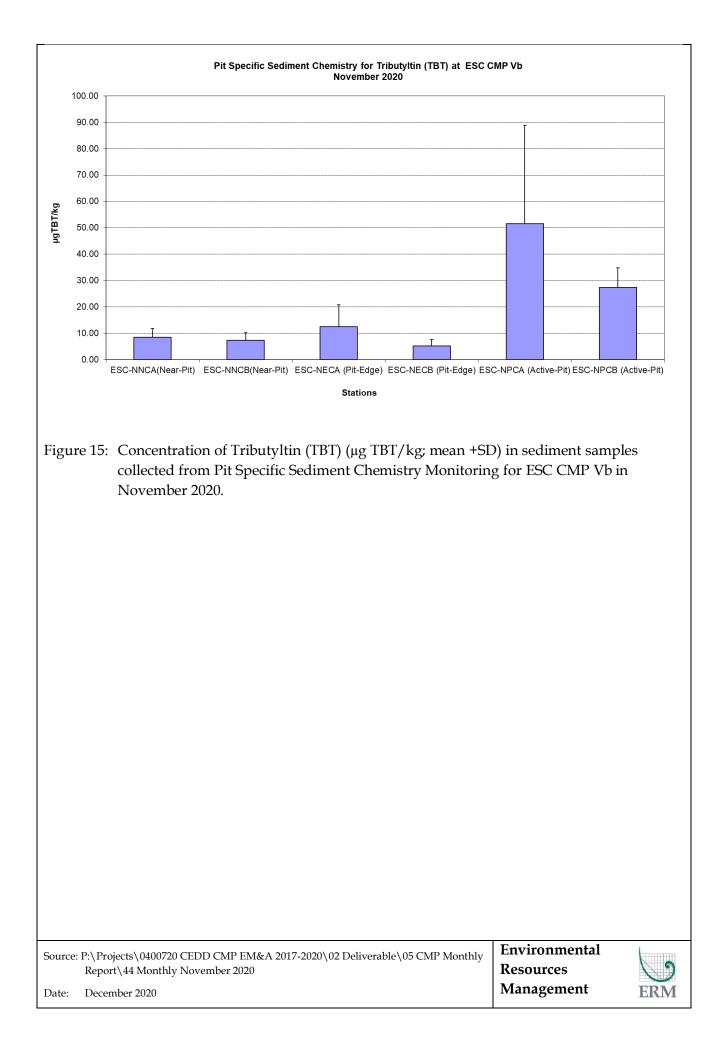
Figure 7: Concentration of Arsenic, Chromium, Copper, Lead, Nickel and Zinc (μg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP V in November 2020.











Annex D

Study Programme

Task Name		Finish		201	7				201	8				201	9				202	20			FMAN	2021			<u> </u>
Commencement of Agreement No. CE 63/2016 (EP)		Sat 1/4/17			JAS		JJF	MA	MJJ	IAS	ONL	JF	MAN	NJJ	AS	ON	DJI	· MA	MJ	JAS		DJF	MAN	NJJ	ASC	DND	JI
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		Mar 5/4/04																							\square		\vdash
Project Management and General Deliverables	Mon 3/4/17	Mon 5/4/21																				Π					
																											i
For the disposal facilities to the East of Sha Chau (ESC) (between 2017 and 2021)	Sat 1/4/17	Fri 1/10/21	i 🐳																+		╪╤╤	÷	+++	++-			rt
and the South of The Brothers (SB) (between 2017 and 2018)																											ı İ
Draft Report on Review of EM&A Manual		Tue 2/5/17		2/5											П												
Final Report on Review of EM&A Manual	Tue 23/5/17	Tue 23/5/17	$\left \right $	23	3/5						++		++		$\left \cdot \right $			++-	$\left \right $		+++	++	+++	++-	$\left \cdot \right + \left \cdot \right $	++-	\vdash
Regular Review of EM&A Manual	Wed 2/5/18	Sat 2/5/20																	\diamond								
Regular Site Inspections of CMP Contractors	Sat 1/4/17	Wed 31/3/21																									T.
Derticipate in Linian Occurs Martiner / Occurs Matines on required by OCDD	Sat 1/4/17	Wed 31/3/21																							\square		\vdash
Participate in Liaison Group Meetings/ Consultations as required by CEDD	Sat 1/4/17	Weu 31/3/21					1															TI					
Submission of Monthly EM&A Report	Sun 14/5/17	Sun 14/3/21		>�	00			*	$\diamond \diamond$	$\diamond \diamond$	00	·		>0	$\diamond \diamond$	\diamond	\diamond	>0	$\diamond \diamond$	00		\rightarrow	>0				īŤ
Submission of Quarterly EM&A Report		Wed 14/4/21	$\left \right $		>	\diamond				>					,	\diamond			<u> </u>	\diamond	\diamond	+		++	\vdash	+++	\vdash
	Fri 14/7/17					ľ			ľ		Ĭ.		ľ			Ť		ľ		Ĭ	ľ						Ш
Submission of Annual EM&A Report	Sun 14/1/18	Thu 14/1/21					\diamond					\diamond					\diamond					\diamond					
Submission of Annual Risk Assessment Report	Thu 14/6/18	Mon 14/6/21							\diamond		++			\diamond	++			++-	\diamond	++	+++	+	+++	\diamond	\vdash	+++	╓┤
	Er: 00/7/04	Eri 00/7/01																			+++		+++		23/7		\vdash
Submission of Draft Final Report (including database of all data collected)	Fri 23/7/21	Fri 23/7/21																									
Submission of Final Report (including database of all data collected)	Fri 27/8/21	Fri 27/8/21													\square										27	7/8	i
Submission of Draft Executive Summary	Fri 27/8/21	Fri 27/8/21	$\left \cdot \right $			$\left \right $		++			++		++	++-	$\left \cdot \right $	_		++-	$\left \right $		+++	++	+++	++-	27	7/8	⊢
Submission of Drak Exceditive Summary																											
Submission of Final Executive Summary	Fri 1/10/21	Fri 1/10/21																								1/10	ī
			$\left \right $			+++					++		++		$\left \right $			++-	\vdash	++	+++	+	+++	++	\vdash	+++	\vdash
For East Tung Lung Chau Disposal Facility (subject to the actual disposal	Sun 14/10/18	Fri 14/12/18	$\left \right $			+++						1			$\left \right $			++-	\vdash	++-	+++	+	+++	++	\vdash	+++	\vdash
programme to be confirmed by CEDD)																											
Submission of Monthly EM&A Report		Fri 14/12/18									000	·															i
Submission of Quarterly EM&A Report		Fri 14/12/18										14/1	12						\square		+++	\rightarrow	+++		\square		\vdash
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Submission of Annual EM&A Report		Fri 14/12/18									•	14/1	12														ī
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Study Programme Task Milestone	•	S	Summa	ary		Ţ)			V I	Rolled	Up N	lilesto	one <	>												
Tue 13/6/17	•																										
Agreement No. CE 63/2016 (EP) Environmenta	al Monitoring a	nd Audit for Di	spos	al Fa	acilit	y to t	he E	ast o	of Sha	a Cha	au (20	017-2	2020)) - In	vesti	gati	on	04	0072(0_CM	P EM	δA Ρι	rogram	ime_v	1_EM{	&A.mr	эр